HFIR

The High Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory produces the Nation's most intense continuous beam of neutrons for materials research and isotope production. About 250 researchers from industrial, academic, and government laboratories perform experiments there each year. HFIR provides state-of-the-art facilities for neutron scattering and materials irradiation and is the world's leading source of elements heavier than plutonium for research, medicine, and industrial applications.

HFIR has four neutron beam tubes with 11 neutron scattering instruments, including several triple-axis spectrometers, a residual stress analysis facility, and a small-angle neutron scattering facility. Facilities are also used for irradiation studies of structural materials for fission and fusion reactors and provide the highest neutron flux available for neutron activation analysis of trace elements in materials.

HFIR is a light-water cooled and moderated reactor with a design power level of 100 megawatts and a normal operating power of 85 megawatts. The flux in the beryllium reflector surrounding the core of highly enriched uranium is about five million-billion (10^{15}) neutrons per square centimeter per second. These neutrons produce radioactive elements for more than 800 customers for use in cancer radiation therapy, nondestructive inspection of explosives and aircraft, and as start-up sources for nuclear reactors. HFIR is the western world's sole source of berkelium-249, californium-249 and -252, einsteinium-253 and -254, fermium-257, and high-specific activity cobalt-60 for research and medical use.

ACCOMPLISHMENTS

Small-angle neutron scattering has been used to test the compatibility of polymer blends by scientists from IBM, Exxon, and Eastman Chemicals. These experiments provide important information on the mixing characteristics of polymers in the 100 million ton per year polymer blend industry.

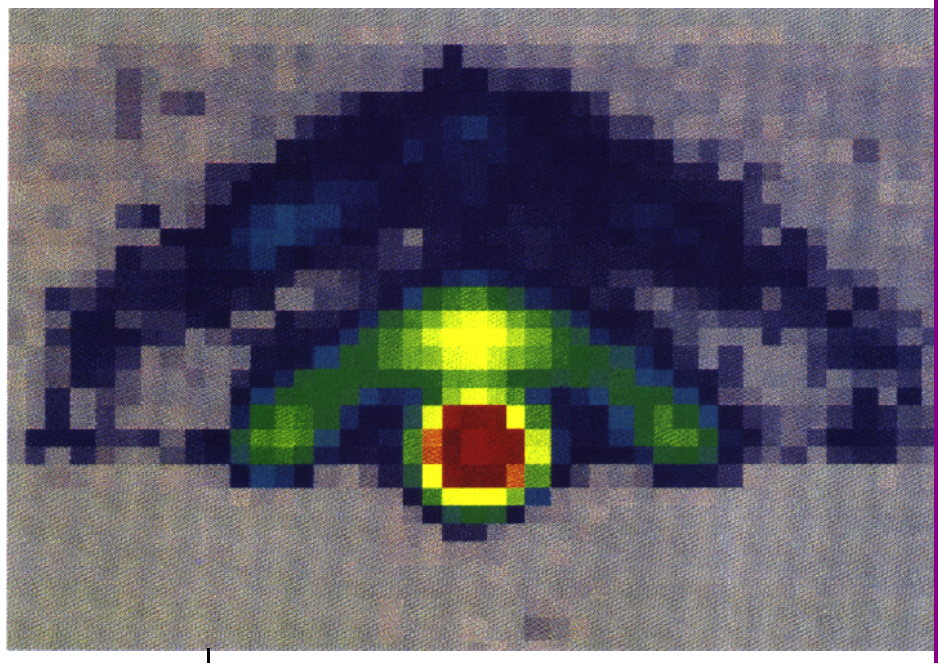
HFIR scientists developed neutron polarization analysis techniques unsurpassed in the thermal neutron region. They have been essential to the study of magnetic fluctuations in high-temperature superconductors in collaboration with AT&T and in measurements of heavy fermion materials in collaboration with the University of California at San Diego.

The structure of complex fluids has been determined by neutron reflectometry and small angle scattering. The hexagonal alignment of normally entangled micelles in viscous solutions under shear has been studied in collaboration with the University of Tennessee and Los Alamos National Laboratory.

Steve Spooner and Stan David of ORNL examine a welded plate mounted in a residual stress apparatus at HFIR. Neutron residual stress mapping is being used to study stress relief in welds, composite materials, and complex parts. The residual stress facility is jointly sponsored by Basic Energy Sciences and the Office of Energy Efficiency and Renewable Energy.

HIGH FLUX ISOTOPE REACTOR

Researchers from ORNL, the University of Kentucky, the University of Tennessee, and Los Alamos National Laboratory are using small-angle neutron scattering at HFIR to study microscopic order in complex fluids. The two-dimensional scattering pattern reveals hexagonal ordering along the flow direction which greatly reduces viscosity under shear, a desirable property for many complex fluids from shampoos to paint.



Neutron scattering analysis of residual stresses in materials and components is being used to study the fundamentals of stress relief in welds, composite materials, and complex parts in collaboration with numerous universities and industries.

Scientists from the University of North Carolina are using small angle neutron scattering to study polymer processing in environmentally safe inert gases, a synthesis approach which would greatly decrease the use of ozone-depleting gases in the polymer industry.

INDUSTRIAL USERS

- Alcoa
- Allied Chemical Corp.
- B&W Nuclear Technologies
- Boeing
- Caterpillar
- Cummins Engine
- Cytec Industries
- Detroit Diesel Corp.
- Doehler-Jarvis
- Eastman Chemical
- Exxon
- Ford Motor Co.
- General Electric
- General Motors
- Grove Engineering
- IBM
- Imperial Chemical Industries
- Lucent Technologies
- Pratt and Whitney
- Procter & Gamble
- Phillips Petroleum
- Phillip Morris
- Raychem Corp.
- Westinghouse